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REPORT WITH THE MOST SUITABLE EXTRACTION CONDITIONS FOR OBTAINING THE PRESERVING COMPOUNDS FROM PUMPKIN BY-PRODUCTS

DELIVERABLE 2.3

PulpIng

Developing of **Pu**mpkin **Pulp** Formulation using a Sustainable **Integ**rated Strategy

Index

Document Information

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1. Summary

PulpIng project aims at the development of a high-quality pumpkin pulp product enriched and preserved by added-value compounds obtained from pumpkin by-products, fostering an integrative and sustainable strategy. Obtaining extracts with high preservative capacity from pumpkin by-products, more specifically the seeds, peel, and fibers, is the main goal of the WP2 – "Sustainable recovery of compounds with preserving capacity from pumpkin by-products". This report regards the deliverable D 2.3 – "Report with the most suitable extraction conditions for obtaining the preserving compounds from pumpkin by-products" of the WP2, that comprises the selection of the important variables to be optimized in the study of the extraction of the preservative compounds.

2. Description of work

To achieve the purpose of Task 2.2, the most suitable extraction conditions were revised in a review article, and the conclusion were briefly discussed in this report. The dependent variables and the responses were selected and described.

2.1. Goal

To select the most suitable extraction conditions to be optimized to obtain of extracts rich in molecules with antioxidant and antimicrobial properties from the pumpkin by-products.

3. Discussion

3.1. Standardized extraction procedure

The preliminary study was developed in 108 sample from different pumpkin varieties and parts of fruit (pulp, peel, seeds, and fibers) from Portugal, Algeria, Greece, Tunisia, and Egypt. The extracts were obtained by the standardized extraction of maceration using ethanol/water 80:20 as solvent, as describe below and schematized in **Figure 1**.

a) Mix 1 g of extract with 30 mL of ethanol/water 80:20 (v/v);
b) Perform the extraction by maceration in room temperature stirring for 1 hour;
c) Filter, saving the extracted liquid;
d) Repeat the extraction procedure with the sample recovered from the filter;
e) Freeze dry the sample.

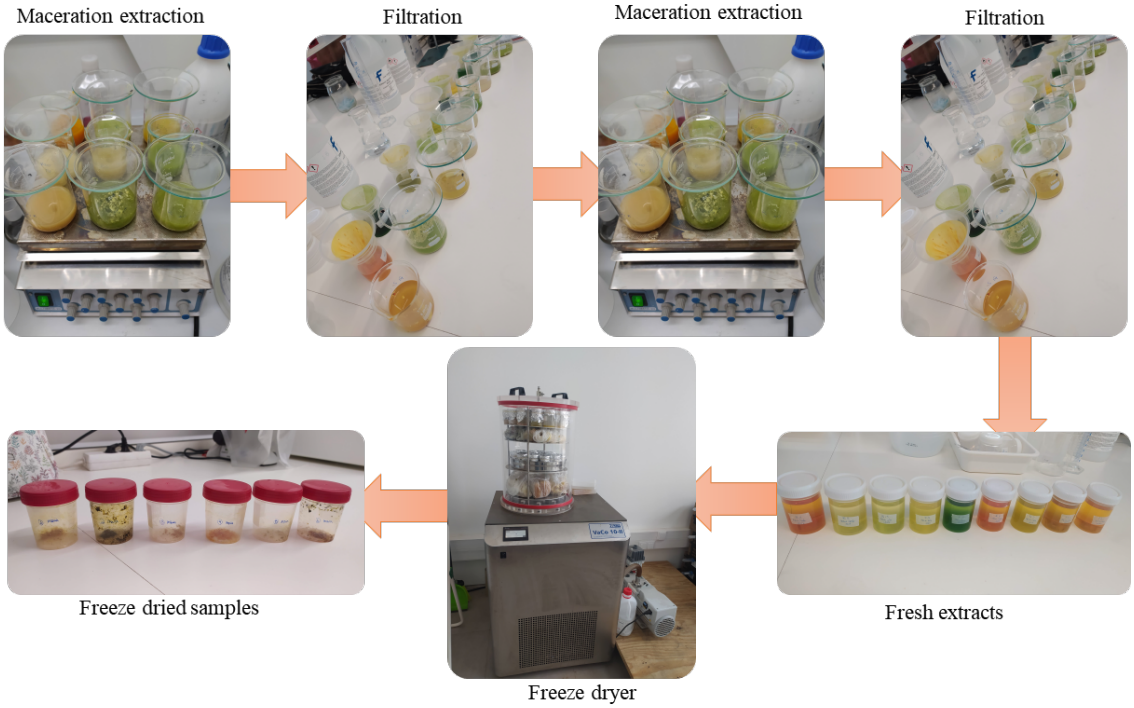

Figure 1. Scheme of standardized extraction procedure.

3.2. Extraction variables

Several conditions can affect the efficiency of the extraction procedure. In addition to the type of matrix to be extracted and targeted molecules, the dependent variables of temperature, power, time of extraction, type of solvent, and solid/liquid ratio, are the most frequently correlated in affecting extraction yields, as previously reviewed [1].

The review [1] was developed focused in the present work PulpIng, and it was important to define the methods and suitable conditions to be optimized in obtaining extracts rich in preservative compounds, as purposed in Task 2.2 – "Optimization of sustainable and industrially feasible extraction processes of natural preservatives".

For that purpuse, the maceration extraction (MAC) and ultrasound assisted extract (UAE) were selected. The first one (MAC) consists in placing the powder sample in contact with the solvent at a certain temperature and time, under stirring. It presents the advantage of being a simple technique, with low requirements in terms of equipment, but it can involve long extraction times and requires high temperatures. On the other hand, UAE is based on cavitation for cell destruction and release of the compounds in the solvent, in order to reduce variables such as time, temperature and amount of solvent. This technique is considered a low cost and efficient alternative, but it involves more resources for installation, maintenance and operational knowledge.

The independent variables selected were time of extraction, temperature for MAC and power for UAE, and solvent. As solvent, the mixture of ethanol and water was selected (with ethanol

concentration ranging from 0 to 100%), as they are green solvents and reported in the literature as suitable for obtaining bioactive compounds. Time and temperature/power are important variables that can improve results, but in high levels they can cause the degradation of the molecules. Despite the importance of the solid-liquid ratio, it was fixed due to the limited amount of available sample.

As responses (dependent variables), the antioxidant activity (measured by the reducing power assay), the content of total phenolic compounds (assessed through the Folin-Ciocalteu method), and the dry residue were monitored in order to select the most suitable conditions.

5. Prospection

Once defined the most suitable extraction conditions for obtaining the preserving compounds (Deliverable 2.3), the optimization study of the extraction of the preserving compounds to obtain the mathematical models (by RSM) (Deliverable 2.4) will be performed.

5. References

1. Leichtweis, M.G.; Oliveira, M.B.P.P.; Ferreira, I.C.F.R.; Pereira, C.; Barros, L. Sustainable recovery of preservative and bioactive compounds from food industry bioresidues. *Antioxidants* **2021**, *10*, 1–20, doi:10.3390/antiox10111827.